Change of color and decay-rate by microenvironments for base-induced chemiluminescence of dioxetanes bearing a biaryl moiety

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One marvelous phenomenon in luminous organisms is color change observed in the bioluminescence of beetles, in which luciferases use the same luciferin as a precursor of emitter to display light ranging in color from green to red. Many efforts including an excellent work using luciferase mutants reported very recently have been made to elucidate how the color is modulated by microenvironments in relation to the luciferase structures. On the other hand, there has been little known of the color change of chemiluminescence derived from CT-induced decomposition of dioxetane, although such type of reaction is responsible for the bioluminescence of beetles, in which the participation of a high energy dioxetanone intermediate, a family of dioxetane, is believed. We report here a first example of the dioxetane-based chemiluminescence changing its color of emission depending on the base used for triggering; a dioxetane bearing an aryl-substituted phenolic moiety displays light ranging from orange to crimson near infrared region, while another dioxetane emits light with two peaks in its spectrum. In addition to the color modulation, we report also chemiluminescence of an optically active dioxetane substituted with a biaryl in a triggering system with an optically active base.

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